A Student-Centered Visually Enhanced Learning Environment: Comparison between gvSIG and Processing

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Abstract

In this paper, a development platform for a student-centered visually enhanced learning environment implementation is chosen from a comparison between two open source options: gvSIG and Processing, both used in different fields than learning. Different features (graphic capabilities, events management, scalability, information management, implementation cost and web support) have been checked for each one. Processing has been selected due to its better visual and scalability features and its lack for severe drawbacks.

1. Introduction

The use of Information and Communication Technologies (ICT) in education has widened the range of learning possibilities and provides the required technological support to create a new learning environment. Classical list-based interfaces are common in virtual environments for online learning and they have well-known open source libraries for implementing them. However, when considering an alternative option based on visual interfaces, they cannot be used and other libraries must be found or developed. In this work, a student-centered visually enhanced interface is selected [1] to ease navigation through complex relationships, including more contextual information and following multimedia principles for learning. The aim of the selected interface is to ease students' online learning experience, along with the pedagogical values of the new European Higher Education Area. This is achieved by means of:

- designing degree maps thereby providing access at any moment to the necessary data for student placement
- avoiding common feelings of confusion in a virtual learning environment
- allowing access to some information, as sometimes that could be a problem in a traditional Learning Management System
- permitting students to identify their own learning pathway; in the same way, subjects could benefit from these improvements in terms of visualization and adaptation to the learning itinerary.

This paper offers a comparison between two open source libraries: Processing and gvSIG, for developing the proposed student-centered learning environment with an enhanced visual interface. The comparison is made from a set of features needed by the selected learning environment. Both options obtain a goodness level for each feature in an analysis process. Next, those goodness levels are summarized into advantages and drawbacks to analyze both implementation options and the final selection is given.

2. gvSIG

The gvSIG is a free Open Source geographic information system (GIS) [2] with GNU general public license (GPL). It has been developed with java programming language, which is a free platform for development and has recently opened its source code also under the terms of GPL. It was promoted by La Generalitat Valenciana of Spain to ease the access and processing with georeferenced data through different remote servers. Its use was initially designed for public administration use, although many professionals have adopted it for private purposes. Since it is a GIS, it provides the common functionalities of this kind of systems [3]: image processing tools, including digitalization and edition tools, as well as vectorial and raster converters; database functionalities, thanks to their usually attached database management system; finally, spatial analysis functions, related to the analysis of different regions of the stored map sets.

3. Processing

Processing is an open source programming language along with its own interface development environment (IDE) [4], both licensed under the terms of GPL. It is based on java language, like gvSIG. It was started by Reas and Fry, from the Aesthetics and Computation Group at the MIT Media Lab, and it is constantly growing in functionalities. It is focused on acting as a tool to ease the building of visual applications for non-programmers as well as initiating them to coding tasks. Its first users were from the field of digital art; however, people from more fields are using it due to the fast visual feedback obtained. Its basic functionalities range from drawing simple static synthetic graphics to interact with real digital processed images dynamically, all through simplified programming techniques.

4. Features of interest

In this work, different features have been taken into account when selecting between gvSIG and Processing for the developing of a student-centered visually enhanced learning environment:

1. Graphic capabilities
2. Management of mouse and keyboard events
3. Modification efforts
4. Information management
5. Implementation efforts
6. Web support

The more important aspect of the proposed learning environment is that it must be able to show complex information and relationships through an intuitive visual way. This fact means that graphics (feature 1) are a key factor in the selection process. Moreover, intuitive navigation through the environment can ease the learning experience, so feature 2 is also a must. Feature 3 is also very important for this kind of systems because teaching plans are constantly evolving and the more flexibility the platform has, the faster its update takes place. Besides, the system should store information about the personal learning process of each user, so database facilities are needed (feature 4). Furthermore, implementation efforts (feature 5) should be as low as possible to achieve minimum implementation cost. Finally, since online availability of the proposed learning environment is desired, web support (feature 6) is also welcome.

5. Evaluation

The six features presented in section 4 have been evaluated for both options: gvSIG and Processing. The gvSIG library offers an easy and comfortable means of navigation (good point for feature 2) and has the possibility of showing different information layers directly (good for feature 1). Its good database connectivity features have to be taken into account, too (feature 4). However, gvSIG needs a precomputed teaching plan, so modifying any subject is translated to recompute the whole planning process (bad score for feature 3). Since it is used mainly for geographical concepts, it needs all data to be statically referenced with respect some coordinate system (not desired, it adds implementation cost – bad score for feature 5-). Moreover, it needs skilled programming techniques (bad score for feature 5) and while documentation is poor, however it is being updated regularly. Finally, since gvSIG is java based, its corresponding plug-in is necessary if any web navigator is used.

The Processing library has been focused mainly on visualization for design and aesthetic purposes. It simplifies the implementation of 2D and 3D visualization projects, so a skilled programmer is not necessary (good for feature 5); however, its lower level codification may entail longer development times than with gvSIG. Since it is focused on visualization, it offers very high quality graphics, as well as accurate animation and interactivity functions (good for both feature 1 and 2), including layers as gvSIG and more (textures, transparency, vectorial images, fonts, …). It is a lower level library than gvSIG, therefore offering increased flexibility with respect to gvSIG when dynamically rearranging the teaching plan, showing different layers and providing any desired interactivity (good for feature 1 and 3). Processing has no default database connectivity; nevertheless, since it is based on java language, database support is implicitly given (bad and good score in feature 5). This fact also implies that a java plug-in is necessary if web access is desired.

Table 1. Feature evaluation for gvSIG and Processing. Bold fonts identify better performance

Evaluated feature	gvSIG	Processing
1. Graphic capabilities	Good	**Very Good**
2. Events management	Easy	Easy
3. Modification efforts	Complex	**Simple**
4. Information management	**Good**	Medium
5. Implementation efforts	High	**Medium**
6. Web support	With plug-in	With plug-in

Processing obtains better results for three features, while gvSIG excels in one; with respect to the other two features, they have the same level for both. The chosen alternative is the Processing library: firstly, it offers richer visual options (feature 1) and better scalability properties (feature 3), which are a critical requirement needed in the selected learning environment, since it must have an enhanced visual performance and must have enough flexibility to allow changes in teaching plans; secondly, the lack of strong drawbacks, which can be found in the gvSIG option for its static definition (feature 3) and the need for high programming skills to get successful implementations (feature 5). Database connectivity, related to feature 4, is better met by gvSIG, however Processing can use java database support to allow similar performance, avoiding a severe drawback in this feature. Events management (feature 2) and web support (feature 6) remain at the same level for both options.

6. Concluding remarks and future work

Since current virtual learning environments are not using all the potential of visualization, interaction and monitoring that the Internet allows today, new alternatives need to be explored. When planning to develop a visually enhanced student-centered learning environment, two open source options have been considered: gvSIG and Processing, both rooted in different fields. Different features have been evaluated for each alternative. Processing appears as the suggested option because of its better performance in visualization power, dynamic teaching plan rearrangement and lower programming skills needed.

Future work includes the implementation of the proposed learning environment and the study of a recent version of Processing for javascript language to avoid the need for any plug-in.

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